U.S. Patent No. 5,068,616, "Monitoring Process and Device of a Quasi-Closed Electromagnetic Shield" discloses a measurement system, however, the source of the radiation is retained inside the enclosure, the frequency range is limited to 1 to 100 KHz, and the source is low power.

SUMMARY OF THE INVENTION

This invention is a low-power/wideband (LPWB) transfer function measurement method and a distributed data acquisition and processing apparatus with which to perform the aforesaid method. The method uses a completely new approach in the art - Stochastic Process Test Technique(SPTT) - for deriving transfer functions and a distributed, rather than centrally located, instrumentation apparatus to manage the test process.

In the invention, an advanced stochastic processing test technique (SPTT) enables determination of transfer functions using LPWB schemes. The system is excited by being radiated with a low power pseudo-random signal that has a concentrated frequency content over a wide, continuous band (wideband). The bandwidth of this signal can be up to several thousand times larger than a CW tone. Therefore, one LPWB pulse can excite the system with the equivalent of thousands of CW tones. This has the advantage of greatly decreasing the time required to make transfer function measurements. Interference with other electronic devices is considerably reduced, because the low power excitation signal has a structure that is similar to noise. Since the excitation is over a continuous band, as opposed to CW which changes frequency in discrete steps, detailed transfer function information is not missed.

LPWB uses a wideband excitation baseband signal and an up-conversion process to operate at frequencies that are greater than the highest modulation frequency of the baseband. The up-conversion process shifts the baseband excitation signal upward to the various frequency

wideband excitation; a method of measuring transfer functions with an indication of measurement quality; a method of measuring transfer functions with the capability of rejecting corrupted data; a method of measuring transfer functions under conditions where environmental (ambient) excitation can be utilized; a method of measuring transfer functions without interfering with other electronic devices; a method of measuring transfer functions without causing a health risk; a method of measuring transfer functions over wide bandwidths without measuring one individual frequency at a time; and a method for implementing a modular distributed instrumentation architecture.

Still further objects of this invention are an unique general purpose physically distributed apparatus for using low-power, wideband radiation to excite a system and determining system's responses to the excitation; comprised of a waveform synthesizer, for transmitting the input low-power wideband radiation to excite a system; multiple receivers, for measuring the system input and output; a digital computer, for controlling the waveform synthesizer and receiver operations and calculating the system characterizations, such as system transfer functions, from the measured data; and a digital fiber optics telemetry system to facilitate communication and synchronization between the physically distributed waveform synthesizers, receivers, and the computer.

These and other objects of the invention may be determined by reading the description of the preferred embodiments along with the drawings attached hereto. The scope of protection sought by the inventor may be gleaned from a fair reading of the claims that conclude this specification.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic diagram showing the general layout of a transfer function;

system. For instance, using a 3 MHz oscillator 17, a fiber optic transmitter 19 can be used that is an off-the-shelf item for transmitting data and clock through the telemetry link. An example of a transmitter usable herein is a Hewlett Packard model HFBR-1414. A fiber optic receiver 20 is provided for receiving data. An example of a fiber optic receiver 20 usable herein is a Hewlett Packard model HFBR-2416.

In the preferred embodiment, both the serial data and the clock are transmitted simultaneously by transmitter 19 along one fiber optic line 15 and received by a fiber optic receiver 20. This is achieved by an innovative modulation method which encodes the reference clock with the data-stream by varying the reference clock's duty cycle. The clock signal is fed to a data/clock modulator 18 to be modulated by the serial output data. To transmit a data logic "0", the duty cycle of the clock is set to 25%. To transmit a data logic "1", the duty cycle of the clock is set to 75%.

On the receive side of the LPWB interface, the received signal is passed to a data/clock demodulator 21 to be demodulated using the inverse of the modulation technique described above. If the received reference clock signal has a duty cycle of 25% then the serial input data is set at logic 0. If the received reference clock signal has a duty cycle of 75% then the serial input data is set at logic 1. The serial input data is converted in converter 16 to GPIB and sent to the computer 14.

LPWB Waveform Synthesizer Module

A block diagram of The preferred embodiment of LPWB waveform synthesizer module 11 is shown in Figure 5. A waveform synthesizer 11 is used in this invention instead of the traditional signal generator 4 because the synthesizer can simulate a wide variety of waveforms while the